

Research Report 1411

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# Surviving a Concentrated Threat: Some Considerations in Cross-Training for Surge

Rene J. dePontbriand, Edward D. Dawdy, and John K. Hawley

ARI Field Unit at Fort Bliss, Texas  
Systems Research Laboratory



U. S. Army

Research Institute for the Behavioral and Social Sciences

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to mission critical tasks (e.g., gunners) during periods of unexpectedly high enemy activity (i.e., surge periods). Unit activities were examined in terms of what must be completed and who is available during heavy combat. Also examined were human factors, manpower, personnel, and training issues related to CTS. Guidelines incorporating minimum necessary considerations for CTS were developed and described following an organizational design and HMPT approach.

Three major areas are discussed. Organizational: identification of mission critical tasks and personnel; identification of the "slack resource" of temporarily noncritical personnel; training in surge-relevant skills; skills maintenance; post-surge readiness. Training: facilitating secondary task performance; need to reduce negative transfer of training. Social: motivational effects of experiencing changes in career progression; effects on group cohesion of massive personnel substitutions in critical conditions.

Research Report 1411

# **Surviving a Concentrated Threat: Some Considerations in Cross-Training for Surge**

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## FOREWORD

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The Organizational Structure/Unit Design work team of the Army Research Institute for the Behavioral and Social Sciences (ARI) conducts research and development in areas that include cross-training of unit personnel in critical activities, an area with applicability for military planning and training. Of special interest is cross-training for combat surge conditions (CTS). There is a variety of important and necessary considerations related to organizational, training, and social factors which must be identified and defined in order to properly plan and/or evaluate CTS designs.

This report describes a set of guidelines and rationale for such planning and evaluation. It presents the development of a minimum set of considerations which must be addressed, as well as some degree of guidance toward implementation.

Further development of the ideas in this report will lead to development of more complete user-oriented procedures for CTS design decisions faced by military planners and trainers.



EDGAR M. JOHNSON  
Technical Director

SURVIVING A CONCENTRATED THREAT:  
SOME CONSIDERATIONS IN CROSS-TRAINING FOR SURGE

EXECUTIVE SUMMARY

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Requirement:

In response to inquiries from the Combined Arms Combat Development Activity (CACDA), the Army Research Institute in 1984 initiated a unit and force design project to look into the area of cross-training for personnel in preparation for combat surge activities. Specifically, a process was sought for evaluating various methods of cross-training for surge (CTS) presented to CACDA by proponent schools. The purpose of CTS is to improve unit and battalion sustainability in a combat surge situation.

It has also been recognized that military leaders, such as battalion commanders, are often inundated with the tasks necessary for battalion and unit operations. In that light, certain key elements in this report have been highlighted (capitalized) to facilitate scanning for particular areas of interest or need. This paper outlines in stepwise fashion a procedure for signaling potential problems and major decision points during the design stage of any particular CTS approach.

Procedure:

The basic approach entails identifying the critical factors involved in the temporary re-allocation of non-critical personnel (e.g., drivers) to mission-critical tasks (e.g., gunners) during periods of unexpectedly high enemy activity (surge periods).

A selected body of relevant military and non-military literature was examined from a human-factors, manpower, personnel and training (HMPT) perspective. Further, unit activities were examined in detail in terms of what must be completed and who is available in combat conditions. Guidelines incorporating minimum necessary considerations for CTS were developed and described, following an organizational design and HMPT approach.

Findings:

THREE MAJOR AREAS ARE DISCUSSED: ORGANIZATIONAL, TRAINING, AND SOCIAL FACTORS. The interested reader may refer to any or all sections. As much as possible, sections are kept independent, to facilitate modification/updating of each separately. A BRIEF CHECKLIST OF NECESSARY CONSIDERATIONS IS INCLUDED IN THE SUMMARY SECTION OF THIS PAPER (p. 17 ). An overview is presented below.



ORGANIZATIONAL CONSIDERATIONS. Identification of mission-critical tasks; identification of personnel temporarily available during surge period (e.g., drivers); matching of critical tasks with available personnel; training personnel in surge-relevant skills (e.g., as gunners); skills maintenance requirements. Also important: to consider training gunners (or others) for post-surge "clean-up" activities such as equipment repair/maintenance, casualty identification. Presented in a step-by-step format.

TRAINING CONSIDERATIONS: Discussion centers around advantages of various approaches for enhancing secondary (infrequently called-upon) task performance. Approaches mentioned include job aids such as labeling, color-coding of equipment, and mnemonic techniques; optimal methods of training; and optimal amounts of training to provide, given military contingencies.

SOCIAL FACTORS CONSIDERATIONS: Identified areas of concern include possible motivational effects of experiencing changes in career progression; effects on group cohesion of massive personnel substitutions in surge conditions, potentially deleterious effects on unit morale of having to replace critical, top personnel in critical tasks by those only secondarily trained in critical tasks. Suggested approaches are briefly discussed.

As in other areas where military doctrine is concerned, many of the questions encountered are specific to the military setting. As such, there is not always a direct transfer of research findings from other areas. For certain questions, there is an identified requirement for military-specific research efforts.

#### Utilization of Findings:

a. As guidelines for use in objectively planning and evaluating CTS approaches. It is anticipated that these findings can be utilized to help maximize combat effectiveness in pre-surge situations and help make more efficient the return to readiness in post-surge conditions.

b. As conceptual basis for guiding applied research efforts in the areas of training for surge/stress conditions.

SURVIVING A CONCENTRATED THREAT:  
SOME CONSIDERATIONS IN CROSS-TRAINING FOR SURGE

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## SURVIVING A CONCENTRATED THREAT:

### SOME CONSIDERATIONS IN CROSS-TRAINING FOR SURGE

#### BACKGROUND

In response to inquiries from the Combined Arms Combat Development Activity (CACDA), the Army Research Institute (ARI) in 1984 began looking into the area of unit and force design; CACDA itself was responding to particular suggestions from proponent schools. With changes in military technologies (equipment, training) and doctrine (e.g., light division) as well as in the nature of enemy threat (e.g., potential battle areas in Central America), the schools were compelled to modify their own doctrine and practices. Such a state of flux can provide the opportunity to examine practices and beliefs which had evolved over time, but which had not recently been addressed in a systematic manner.

This paper was written to provide guidelines for examining current and proposed practices as suggested by the various schools, as well as for planning purposes.

ONE KEY AREA OF CONCERN FACING THE SCHOOLS WAS, simply stated, THE NEED TO SURVIVE A CONCENTRATED THREAT. The training necessary to meet such a threat was seen in need of new direction.

Of particular importance was the question of HOW TO BEST PROVIDE FOR THE OPTIMAL ALLOCATION OF PERSONNEL DURING PERIODS OF SURGE IN COMBAT ACTIVITIES. For purposes of definition, as the term is used here, "surge periods" are those characterized by a need for response to high load and personnel attrition resulting from enemy activity. The surge period would end only when the threat is neutralized at least long enough to replenish resources and carry out necessary maintenance activities.

CACDA's stated need was in part for A SET OF GUIDELINES WITH WHICH TO EVALUATE or improve upon suggestions from the schools for WAYS TO UTILIZE, for example, AN ORGANIZATION'S SUPPORT STRUCTURE DURING PERIODS OF SURGE. In order to provide such guidelines, a first step is to focus on and characterize a specific type of problem solution. Considering the two major elements at hand (personnel and equipment), the question proffered centered around how to best employ available personnel during surge. One possible approach entails transforming functions, utilizing the strategy known as cross-training (C-T). In this case, C-T MIGHT BE UTILIZED TO HELP OPTIMALLY PROVIDE, IN EFFECT, A SUBSTITUTE PERSONNEL RESOURCE. THE CONCEPT OF SAVINGS UNDERLYING THIS FORM OF TRAINING IS COMPRISED OF TEMPORARILY TRANSFORMING PERSONNEL RESOURCES DURING SURGE VS. OVER-DESIGN FOR NON-SURGE PERIODS.

The notion of C-T in the military currently exists in several forms. These will be briefly reviewed below. The discussion will then center around one particular approach to C-T.

## Current Forms of Cross-Training

**CAREER CHANGES:** One form of cross-training occurs when an MOS is phased out or a career-path modified, perhaps as the result of changes in equipment or doctrine. "Cross-training," more appropriately referred to as re-training in this case, is used to provide the soldier with a new set of primary skills. (See Skinner, 1983, AD-A135927). As described here, this form of C-T does not apply to the situation under examination.

**COMMON SOLDIERING TASKS.** On one level, it seems a logical matter to train soldiers not only in their primary duties, such as radar repair, but also on a set of secondary tasks (e.g., gunners), to be utilized during time of emergency or temporary need. Indeed, the traditional sequence of training involves a broad-based set of common soldiering tasks, introduced during basic training. These tasks are described, e.g., in Soldier's Manuals and in FM 21-3, and include first aid, handling the M-16 rifle ("every soldier is an infantryman"), operating communications and navigation equipment, etc. No matter what their MOS, soldiers must be cross-trained so as to possess the skills required for common soldiering tasks. Although sometimes referred to as C-T, this is more accurately seen as part of soldier training--i.e., training as a soldier first, as a specialist second.

**SECTION TRAINING.** Most closely addressing the need referred to in the introductory paragraph is cross-training which would be carried out as part of "section training" (e.g., as described in FM 6-50). There are three objectives of section training:

1. To train individuals in their primary tasks.
2. To train the section as a team.
3. To cross-train individuals in the various tasks, duties, and responsibilities within the section.

How should cross-training be viewed within the battery/section? According to FM 6-50, cross-training is extremely important to overall mission readiness as well as to the professional development and advancement of the soldiers in the section where it is conducted. Without cross-training, sections are kept from operating effectively, since individuals are not prepared to function adequately on more than one job. Further, soldiers who do not become proficient in their present and next-higher skill level cannot qualify for promotion.

These last two approaches termed cross-training above are peripherally related to the surge conditions under consideration. Yet, they lack some specific features which would more closely meet the present need. It is to such features that the discussion will now turn.

## CROSS-TRAINING FOR SURGE

### Overview

The remainder of this paper will deal with several aspects of C-T as it might apply to preparing for conditions of surge. As described earlier, C-T for common soldiering tasks is already institutionalized (as described in Soldier's Manuals). Furthermore, some guidelines do exist concerning when and how C-T might be conducted within sections (as described in FM 6-50). Thus, the notion of military cross-training for certain requirements is, in general terms, not new.

However, A CONCEPTION OF CROSS-TRAINING NEEDED TO MEET THE PRESENT PURPOSE WOULD REQUIRE TWO SEPARATE CHARACTERISTICS:

a. It is appropriate for only selected personnel, e.g., those who would be available for duty (free of other immediate duties), near combat action, and trainable for a specialized task.

b. It is geared specifically toward meeting needs arising during surge conditions.

To differentiate the term from previous uses, the modified form "Cross-Training for Surge" (CTS) will be employed here in referring to this new variation of C-T. This paper will proceed by addressing the following points related to CTS:

a. Importance of standardization of training guidelines

b. Feasibility considerations, in regards to:

(1) Organizational and administrative guidelines

(2) Training considerations

(3) Social factors (motivation, morale, cohesion)

c. Checklist. The final section will review the major points addressed, and in so doing present a checklist of CTS feature. The use of such a checklist would be expected to facilitate either the evaluation or planning of future CTS models. (See Summary.)

### Standardization

A key question which arises in deciding who and how to train is, How to identify critical personnel? Ancillary to that question are issues concerning which sub-set of tasks should be chosen for optimum CTS.

These matters, identifying key personnel and key tasks, have heretofore been left to the judgment of individual unit commanders. However, the questions and suggestions received by CACDA point up an apparent need for standardization of such procedures. The need for such standardized guidance

has recently been discussed elsewhere (Fitton, 1985), in relation to the development of military doctrine in general; nowhere would standardization be more appropriate than in the early stages of training efforts. CACDA's current need is for guidelines for use in evaluating suggestions for CTS from the various schools. This paper will discuss a procedure to identify or classify the important factors which must be taken into account in evaluating CTS proposals.

THE INTENTION IS TO OUTLINE A USABLE PROCEDURE WHICH, FOLLOWED ACCORDING TO SEQUENCE, CAN SIGNAL POTENTIAL PROBLEMS, DRAWBACKS AND MAJOR DECISION POINTS DURING THE PLANNING OR EVALUATION PROCESS. This should permit certain types of errors to be avoided before commitment is made to their execution, and should provide for a more sound and efficient planning process. It should be recognized that this procedure is neither exhaustive in scope nor carved in stone. That is, it is amenable to change as needed to meet situational requirements and other developments. ITS MORE APPROPRIATE USE WILL BE AS A STEP-THROUGH CHECKLIST IN EVALUATING THE THOROUGHNESS OF SUGGESTED FORMS OF CTS, OR AS A GUIDE IN DESIGN CONSIDERATIONS.

Before beginning the main discussion, a few more basic points must be introduced. These have to do with the essential feasibility or practicability of CTS.

#### Feasibility

Some of the issues surrounding CTS are not immediately obvious. Perhaps the principal question concerning CTS deals with feasibility. Three major aspects of feasibility have to do with the interrelated matters of:

- a. Organization and administrative concerns
- b. Training considerations
- c. Social factors (motivation, morale, cohesion)

While all three aspects deserve discussion, the main focus here will be on organizational constraints. The reason for this is simple practicality. If, in evaluating various proposed approaches, potential constraints and sanctions are found to be too costly or even insurmountable in certain cases, the proposal would be dropped. In that case, there would be no need for concern with training or social factors. This is not to say that such factors are unimportant, but rather that their need is predicated on the status of other system constraints.

#### ORGANIZATIONAL CONCERNS

The notion of feasibility for CTS carries at least one important assumption that warrants brief mention. CTS CONSTITUTES THE CAPACITY TO RE-ALLOCATE KEY PERSONNEL DURING SURGE. THE IMPLICIT ASSUMPTION IS THAT A BATTALION'S MODIFIED TABLES OF ORGANIZATION AND EQUIPMENT (MTO&E) DESIGN IS SUCH THAT "SLACK RESOURCES" ARE TEMPORARILY AVAILABLE DURING SURGE CONDITIONS. Such an assumption is correct based on the premise that the MTO&E reflects personnel and equipment necessary to meet sustainment (The level of force

needed to meet the expected enemy threat levels), and not surge (characterized as unexpected, if temporary, threat levels), conditions. To the extent that such is the case, and evidence suggests that it is, the MTO&E may include cooks, drivers, military police (MPs), mechanics, etc., whose designated tasks may be cyclical or otherwise postponable during surge. That is, for some temporary period of time, such personnel make up a "new" pool of resources which was not available during normal sustainment of operations. Logically, such would be the case in any optimally designed organization.

This resource pool would most likely be available if an approach similar to the Force Packaging Methodology (FPM) were applied. According to FPM, those forces most critical during the early stages of conflict (when surge may well occur) are systematically identified. These forces receive highest priority and consequently are resourced at a higher level than are other forces. The result is a higher likelihood of reserve combat capability.

A SECOND POINT HAS TO DO WITH WHAT TAKES PLACE DURING SURGE CONDITIONS, TYPICALLY RESULTING FROM AN UNFORESEEN OR UNEXPECTEDLY INTENSE ENEMY ATTACK. When would substitute individuals be needed? Only when (a) primary key-position holders (e.g., gunners) have been taken out of action, i.e., must be replaced due to exhaustion or casualty, or (b) more depth is needed. How long can/must substitutes be away from their own primary duties? This may depend on the nature of the threat, on the amount of ammunition available, physical fatigue, maintenance-free period of operation of the equipment, or, a likely limiting factor, a general need to return to and perform the primary duty at some point. Potential limiting factors for a given set of scenarios must be addressed in any feasibility study.

ANOTHER POINT OF CONCERN ARISES WHEN CONSIDERATION IS GIVEN TO WHAT OCCURS SUBSEQUENT TO SURGE. Do things immediately revert to "sustainment mode" conditions? In actuality, likely they do not. Primary key position holders will either never return, or will return only after some period of recuperation. The substitute personnel must, if they are capable, return to and re-normalize their postponed duties. Both situations suggest a very poor, transition, state of combat readiness immediately following a surge. The transition state, or window of vulnerability, may not be normalized, typically, until reinforcements are available.

SINCE IT IS IMPERATIVE THAT READINESS BE QUICKLY REGAINED, C-T MAY BE REQUIRED IN THE REVERSE DIRECTION AS WELL. That is, gunners may, post-surge, be needed for body-tagging, ammunition re-supply, or equipment repair and maintenance. Re-normalization in this sense is so critical that it perhaps should be addressed as a separate topic, but it needs to be mentioned here as well.

This leads to the conclusion that an enemy threat must not only be met, but that beyond this the threat must be neutralized for some period of time ("beaten back") to allow for return to designed combat readiness. In one sense, the substitutes must perform at least as well as, if not better than, the primary troops if such neutralization is to be realized. (One element favoring the substitutes' performance in comparison to that of the regulars is that any degree of surprise held by the enemy would soon be spent.) Another important step is to identify which forms of available weaponry and other equipment (e.g., communications) are most critical during surge; these are natural candidates for CTS consideration.

## CTS Analysis

As state above, THE MAIN FOCUS HERE IS ON DETERMINING THE FEASIBILITY OF CROSS-TRAINING FOR SURGE. This topic was discussed in a concept paper by Dawdy and Hawley (1984), the substance of which is included below. The procedure, which can be termed a CTS feasibility analysis, is a logical, step-wise approach consisting of four essential stages.

a. Identifying a pool of scenario dependent target tasks which must be performed in order to maintain unit functioning. These "target" sets of tasks are the focus for CTS.

b. Identifying those individuals who (1) can be temporarily freed from other immediate duties; (2) are foreseeably near enough the combat scene to potentially substitute for a casualty or otherwise augment personnel in the critical position, and (3) have the aptitude to be properly trained and to maintain the necessary skills. This group makes up the source pool of personnel to be trained.

c. Conducting a cost-benefit trade-off analysis on the target-source combinations to identify those which should be considered in more depth.

d. Determining the remaining feasibility (organizational, logistical, administrative) of potential target-source combinations.

A CTS feasibility analysis, then, is concerned with the relationship between cross-training and unit effectiveness. The analysis, in this case, is directed at the problem of identifying options for temporarily increasing the unit or section's designed effectiveness under heavy load or in the face of combat losses while using only existing, intra-unit (or section) personnel and equipment resources.

Once the critical elements have been identified (steps 1 & 2), the feasibility to be determined is two-fold: (a) A target-source cost-benefit analysis represents an assessment of the military utility of using the previously identified task-personnel combinations; (b) the target-source feasibility assessment concerns the a priori feasibility or possibility of attempting to train and employ members of the source pool to perform target tasks. It is important that this order be maintained, if efficiency in the procedures is to be achieved. In particular, performing such a cost-benefit analysis could conceivably negate having to pursue a number of potential but low-utility combinations.

While certain selected combinations might be feasible (i.e., personnel are deemed available, nearby, trainable), the logistics of training could well present unrealistic and unachievable requirements. In the second sense, selected target-source matches may be found to provide only tenuous or insignificant increments in unit capability. Thus, feasibility turns into an issue of joint criticality--in simple terms, the combinations must be jointly achievable in nature and meaningful in result.



## STEPS IN CONDUCTING THE ANALYSIS: FUNCTIONAL OPERANTS

As stated earlier, the purpose of these guidelines is in part to aid in the evaluation of various suggested alternative forms of CTS. Since there can be a variety of constructions which might be considered, a common focus could provide order to the evaluation task; one such focal point will be presented below.

IN ORDER TO ADDRESS THE FOUR ISSUES NOTED ABOVE, IT IS FIRST NECESSARY TO CHARACTERIZE UNIT ACTIVITIES REQUIRED UNDER STATED MISSION CONTINGENCIES. A standardizing mechanism to help serve this purpose involves describing unit requirements in terms of what are referred to as functional operants (FOs). As the term is used here, a FO is defined as a unit function which must be performed to designed standards; any decrement would critically lessen the probability of mission success. Examples of potential FOs are:

**CONTACT OPERANTS:** Operants engaged in activities that deal with direct or indirect contact with the enemy. Examples: infantry operations, artillery fire, air assault, and armor operations.

**CONTROL OPERANTS:** Operants engaged in activities concerned with directing the performance of other operants. Examples: command posts, operations centers, military policing.

**INFORMATION OPERANTS:** Operants concerned with gathering and assimilating the input required to control other operants. Examples: intelligence/survey team activities, meteorological activities.

**MOBILITY OPERANTS:** Operants concerned with the transportation of personnel, equipment, or supplies.

**MEDIA OPERANTS:** Operants concerned with transferring information among other operants. Examples: message transmission/reception (TR); data TR.

**SUPPORT OPERANTS:** Operants required to sustain other operants. Examples: supply, maintenance, food service, and medical service activities.

Once unit FOs are identified, they must be organized hierarchically into what is termed a "network dependency structure," for subsequent use in the CTS analysis. (Figure 1 presents an example of a hypothetical operant dependency structure for artillery fire.) Much of the information required to develop these hierarchies can be obtained from unit mission and collective front-end analyses; such analyses would utilize Commander's, Soldier's, Field, and Training Manuals. The CTS analysis outlined below is based on the notion of FOs.

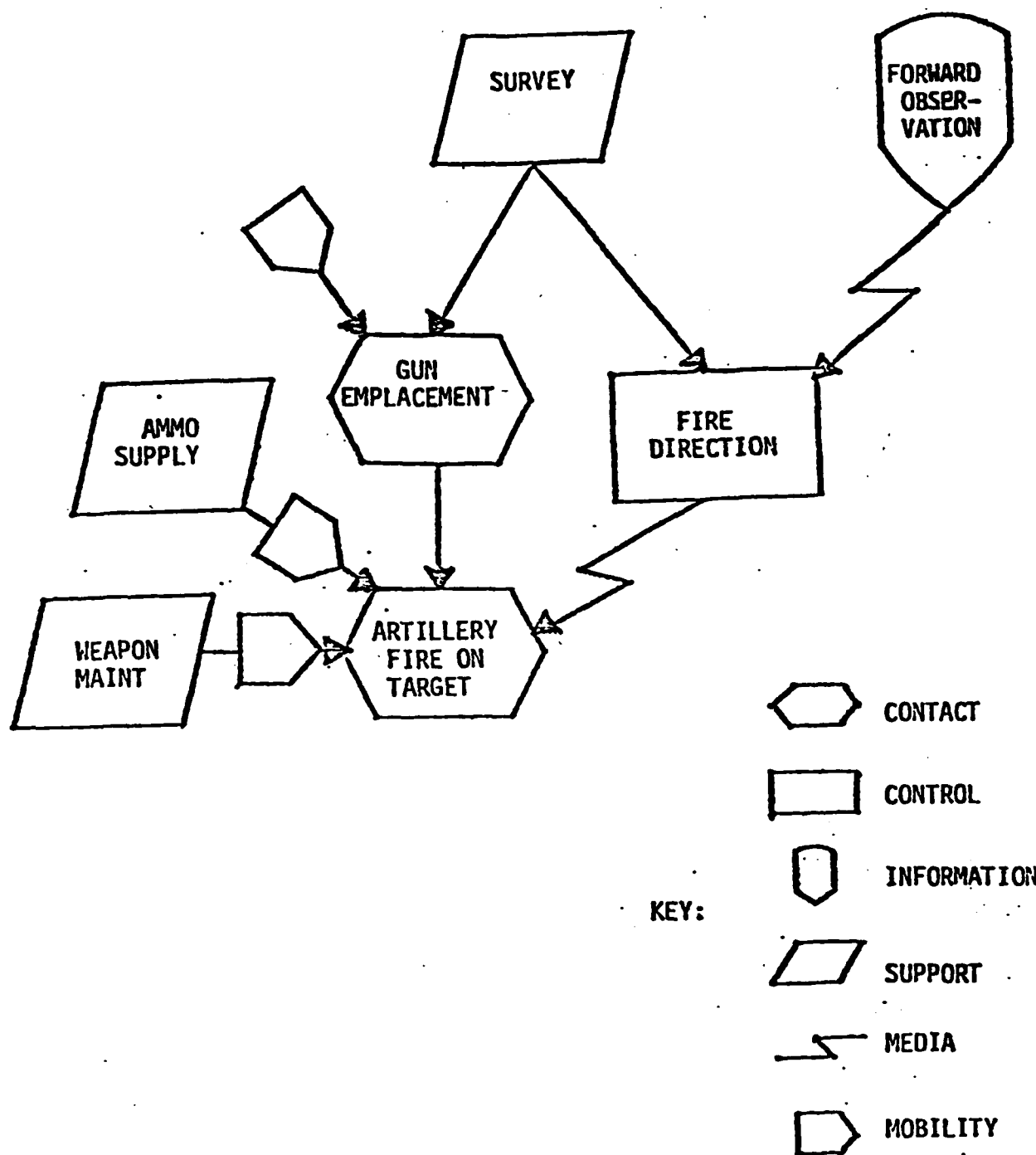


Figure 1. Partial UFO Dependency Structure

1. ESTABLISH TASK TARGET POOL. The first step in a cross-training analysis involves identifying a set of tasks for CTS Candidate task are those which (a) must be performed under selected mission contingencies and (b) are determined to have insufficient personnel depth to insure unit effectiveness in the face of high load or casualties. The nature of these selected contingencies of course varies with such factors as type of unit and anticipated combat environment. Tasks for the target pool are identified by reviewing the FO dependency structure and identifying mission-critical operants that are non-redundant. (The term non-redundant here refers to functional requirements that are not likely to be covered in sufficient depth.) Tasks comprising activities within non-redundant FOs are included in the target pool, and thus become candidates for CTS.

2. PERSONNEL SOURCE POOL. The second step in the cross-training analysis concerns identifying a pool of personnel potentially available for CTS in mission-critical tasks. Source pool candidates are identified by reviewing the FO dependency structure and noting operants that are not absolutely required during critical periods. Additional candidates are those personnel whose primary duties would not be unduly compromised by the imposition of intermittent or short-term secondary responsibilities. For example, serving as revenge-mode Stinger gunners would seemingly not interfere with the primary duties assigned to military police personnel. These personnel would thus be considered candidates for use as Stinger gunners.

3. ESTABLISHING THE POOLS. One approach to establishing the needed Target and Source pools is derived from the hierarchy presented in Figure 1.

a. Review the structure, using the critical load time as a criterion, and remove operants which by judgment could be delayed beyond the time established for analysis; list these as Source items.

b. Start with the operant at the top of the structure and record the number of subsequent dependent operants (ND). Continue down through the structure until each operant has an ND recorded for it.

c. Using the unit operant structure, identify operants which are in a non-redundant path, listing them as Target items.

d. Review the operants in the structure that have not been identified as either source or target items. Select operants that are reasonably redundant and add them to the source list; add the remaining operants to the target list.

#### Utility Assessment

The next two steps may be transposed at times, depending on the organization under assessment. THE CRITICAL RESPONSIBILITY IS TO ELIMINATE AS MANY UNACCEPTABLE (INFEASIBLE, LOW UTILITY) ALTERNATIVES AS POSSIBLE AT THE EARLIEST POINT IN THE PROCESS POSSIBLE. SUCH A PARSIMONIOUS APPROACH IS NECESSARY IF EFFICIENCY IS TO BE ACHIEVED AND MAINTAINED IN CARRYING OUT THE PROCESS.

4. COST-BENEFIT TRADE-OFF. If at this point a candidate source operant has not been rejected, its members provide a feasible pool of personnel for CTS in the target operant tasks. Before making a final decision, however, an assessment of the overall military utility of implementing CTS choices must be made. The notion underlying CTS is the temporary sacrifice of one functional operant to sustain another activity judged more critical. It is necessary to insure that the source operant can indeed be sacrificed temporarily, and that the cost of preparing for the anticipated substitution will be offset by an expected gain in combat capability.

Optimization of the utility process at this point requires, at minimum, ranking of Target and Source lists for use as a guide; the objective will be to trade minimum sacrifice for maximum gain. This can be described in two steps, to be carried out by subject matter experts (SMEs):

a. Weighting the Operants and Rank Ordering the Target and Source Lists. Establish survival probabilities (SP), during the time frame to be addressed by the analysis, for the unit functional operants by either adopting figures used for "war game" models or by obtaining estimates from SMEs.

For each operant, divide its ND by its SP to obtain an operant weight (OW). The OW reflects the criticality of each operant to mission success or to survival. A high Target OW represents a high need for redundancy, while a high Source OW indicates existing high redundancy.

Rank order the Target list so that the operant with the largest recorded OW is at the top.

Rank order the Source list so that the operant with the smallest recorded OW is at the top.

b. Optimizing Trade-Off. Start sequentially down the Target list, and attempt a match with the first Source on the Source list. The potential match must be accepted or rejected on the basis of a feasibility investigation. If the possible match is rejected, test for the possible match until the Source list is exhausted.

If the Source list is exhausted, the target unit functional operant is considered critical, and no feasible match is found, consideration should be given to modifying the unit's designed posture.

The matching process continues until the Target list is exhausted or until the operants remaining on the list are not considered by SMEs to be critical.

4. SOURCE-TARGET FEASIBILITY ASSESSMENT. The final step is to determine which of the potential source-target matches are indeed feasible; this is actually performed by the rejection of infeasible target-source candidates. Potential constraining factors include: (a) source-target combat role congruence; (b) training prerequisites; (c) initial skill acquisition; (d) skill maintenance. Each of these constraints is discussed below; the Manuals mentioned earlier could provide an a priori source for guidance. It can be seen that, in the order presented here, this fourth step is quite costly in terms of resources and time required for adequate completion. This is precisely the purpose for its being included only after the largest number of alternatives have been eliminated.

a. Role congruence concerns whether source members' primary jobs will place them in the right place at the right time, with manageable role demands to perform specific secondary responsibilities. For example, if MPs are to be trained as revenge-mode Stinger gunners, will their normal combat responsibilities place them in a location where they can be useful as gunners? If not, training them as gunners would have no utility, i.e., might be feasible, but of no value.

b. Prerequisites. If source personnel pass the first step, they must next be deemed to possess the aptitudes required for admission to secondary training (CTS) courses (see AR 611-201) or may have to be rejected. The definition of "aptitude" used here would differ from that in AR 611-201, since CTS candidate personnel would likely be trained only for part of the duties required of another military occupational specialty (MOS).

c. The third feasibility consideration is initial skills acquisition within CTS itself. If the identified tasks are to be performed by unit or section members, as stated earlier, CTS can be conducted as part of section training. Several practical approaches are suggested in FM 6-50; an example is presented in the following paragraph.

FOLLOWING TRAINING TO SOME PRE-SPECIFIED CRITERIA, THE SECTION SHOULD BE READY FOR UNIT-LEVEL TRAINING. In the likely occurrence that time and resources required for unit training are not available at this point, the time could be used for section-level CTS. Typically, CTS could be conducted by going through section training again, the second time with individuals either in another job at the same level or in their present job but trained at the next higher level. The vacated positions would simulate combat losses. Section evaluations (as outlined in the appropriate Field Manuals) would help identify weak areas in need of continued training.

In the broader case, WHERE CTS CANNOT BE PART OF SECTION TRAINING (E.G., TIME RESOURCES, COMMANDER, ETC., CANNOT BE MADE AVAILABLE), THE NORMAL TRAINING PIPELINE WOULD HAVE TO BE UTILIZED. HERE, OTHER BASIC, BUT IMPORTANT, ISSUES OF ORGANIZATIONAL LIMITATIONS MUST BE ADDRESSED.

a. Can existing training sites accommodate the extra load imposed by CTS demands?

b. Will source personnel be in reasonable proximity to an appropriate training site? If not, what provisions will be made to transport them to the appropriate site, and maintain them for the duration of the required training?

c. What effect will non-traditional personnel have on the conduct of existing training? Many current courses are based upon assumptions concerning entering trainees' skills and knowledge; altering the trainee pool in any significant way can thus effect the instructional process. A possibility would be that CTS would have its own set of training materials, or comprise a special course.

If issues such as those noted above cannot be realistically and favorably resolved, it is advisable to reject the source personnel. If the problems are too severe, the CTS option under consideration may have to be redesigned or rejected.

4. After source personnel receive initial training, provisions also must be made for skill maintenance. Relevant issues include:

a. Are all source personnel to be stationed in reasonable proximity to a site where appropriate refresher training can take place? What provisions are necessary for personnel who are not? What are the available alternatives? An example might be programmed instructions geared toward refresher training; however, the level of performance required might well demand actual drills.

b. What are the requirements for proficiency maintenance (e.g., facilities, number, length, scheduling of sessions)? Can existing training facilities accommodate the added load?

c. How much time actually will be available to adequately conduct CTS? Is it practical for an extended period of time?

d. Other organizational considerations: Will source primary organizations support the additional training requirements, or will they tend to "token participate?" Evidence obtained by TRASANA in Europe indicates, for example, that initial C-T may not be the major problem. Rather, maintaining skill proficiency in the field is difficult; one aspect of the problem is that primary organizations may not support skill maintenance programs for secondary roles, at times using personnel as drivers or other special duties in place of the intended training (Tubbs, Craig, Hansen, Hughes & Zamarrita, 1984, # TRASANA 17-84). This might be subject to change over the long run but it is an operating reality at present.

ISSUES SUCH AS THOSE ABOVE MUST BE ADDRESSED REALISTICALLY. EVEN HIGHLY MOTIVATED PERSONNEL IN ELITE ORGANIZATIONS WILL NOT MAINTAIN SECONDARY ROLE PROFICIENCY IN THE FACE OF NUMEROUS AND RECURRING FACTORS THAT IMPEDE SKILL MAINTENANCE ACTIVITIES.

#### TRAINING CONSIDERATIONS

Clearly, a number of training issues are inseparable from organizational constraints. A number of such interrelated issues were put forth above. However, there is a class of more purely training-specific matters equally worth of mention.

One of these is practical and somewhat obvious in nature, but deserves recognition: IT IS NEITHER NECESSARY NOR IMPORTANT TO CONDUCT CTS TO A LEVEL QUALIFYING FOR A FULL MOS IN A NEW AREA. For example, equipment-repair training might not be required, because in surge conditions there might well not be time for such repairs. It is another matter whether repair capability might be needed in the post-surge, return-to-readiness period. ONLY THE CRITICAL TASKS PREFERABLY PACKAGES AS SET OF MEANINGFUL TASKS, AS REQUIRED. Which tasks are critical would need to be determined according to procedures such as those already outlined.

To facilitate CTS as pertains individuals, IT IS IMPORTANT THAT CRITICAL TASKS NOT BE HELD IN ISOLATION. THESE TASKS SHOULD BE SUPPORTED BY JOB AIDS AND/OR BE INCLUDED AS PART OF A LOGICAL SEQUENCE (Gagne, 1961). This would be

particularly important in the case where the substitute's primary and secondary activities may be close in general procedural similarity, yet requiring their own specific sequence of operations (e.g., the firing of two different types of weapons). This issue is termed "stimulus generalization" by learning theorists: Responses to a particular stimulus (an item, object or event) will generalize to (be repeated in the presence of) similar stimuli. In the worst case, such generalization could be fatal or disastrous.

Four possible solutions to unwanted generalization would be:

a. TRAIN PERSONNEL IN THE INDIVIDUAL TASKS FIRST, THEN TRAIN THEM IN THE SEQUENCE OF TASKS (the actual procedure). This approach entails:

- (1) A task analysis (already performed in earlier steps)
- (2) Component task training
- (3) Inter-task transfer training
- (4) Learning of the subtask sequence

This can be a costly approach, but an important one to consider, in particular for more complex activities. Other possible solutions are listed below.

b. PROVIDE JOB AIDS WHICH HELP DIFFERENTIATE THE TWO SETS OF ACTIVITIES (colors, labels, mnemonics, etc.).

c. PROVIDE OVER-LEARNING OF THE TWO SEPARATE SETS OF ACTIVITIES TO HELP INSURE THAT EACH SEQUENCE IS EASILY DISCRIMINATED FROM THE OTHER.

d. FOR A CERTAIN CLASS OF SECONDARY TASKS, DO NOT CHOOSE PERSONNEL WHOSE PRIMARY AND SECONDARY TASKS ARE SO ALIKE THAT A FATAL INCORRECT MOVE WOULD LIKELY OCCUR.

ONE CONSTANT WHICH MUST BE REMEMBERED IS THAT THE RESULTS OF CTS ARE CALLED UPON ONLY DURING VERY STRESSFUL PERIODS WHERE THE TIME ALLOWED TO THINK THROUGH ACTIVITIES IS COMPRESSED, AND THERE IS A TENDENCY TO FALL BACK ON A "NORMAL" CHAIN OF ACTIVITIES. SUCH AN OCCURRENCE MAY BE FATAL, as there is not always a second chance to perform a critical task in the face of combat.

The area just mentioned is one with little military-specific research. As such, the best guidance is necessarily a mixture of logic (common sense and experience) and theory. In psychological terms, the relevant theories discussed above may be termed Hierarchy of Habits (learning the sequence of individual tasks), Proactive Inhibition or Negative Transfer of Learning (past learning interferes with new learning), and a related theory, Stimulus Generalization (described above).

There is of course the situation where stimulus generalization is beneficial. It may be that two weapons are indeed alike in basic operation, and having operator knowledge of one shortens the learning time needed for the other. Such situations can lead to rapid train-up of source personnel, and should be explored whenever possible either with the help of SMEs or through simple testing and observation.

#### Alternative Forms of CTS

A recent review of military training-related research (Hagman & Rose, 1983) can also provide useful guidelines for use in considering CTS alternatives. The major relevant findings are as below.

**AMOUNT OF TRAINING.** It was generally found that overlearning or repetition of tasks leads to shorter performance times and fewer errors--in other words, is beneficial. In terms of cost-effectiveness, the reviewers' findings suggested that such overtraining take place during the initial training rather than by way of refresher training (with its substantial set-up and coordination costs). At this point there is little reason to think the case would be different for CTS.

**METHOD OF TRAINING.** Example: Testing. In cases where the task does not include a job aid, and particularly in cases where there is a long period of no practice on the task, it was found that testing embedded in the training sequence can facilitate retention of the learning. Noting the organizational problems inherent in scheduling and conducting refresher training for CTS-like activities mentioned earlier (in TRASANA, Europe), this approach takes on added importance.

**JOB AIDS.** Example: Mnemonic Technique. The findings reviewed indicated that a job aid such as mnemonic techniques (in the example reported, "the first letter of each successive word in a highly image-creating sentence was the first letter of each successive mine-installation step" p. 208) might be more effective than rote repetition of the task only for complex tasks. The suggestion derived from this would be to either simplify the CTS tasks where possible, or otherwise to use job aids.

The military currently makes wide use of aids such as color coding, labeling, etc., approaches which could be adapted to enhance CTS and subsequent performance. An attractive feature of such coding is that no real modification of equipment is required to incorporate the scheme. The fact is that properly developed job aids do not detract from performance; depending on the costs involved, job aids should perhaps be considered standard items for any form of CTS.

While there is a good deal of existing knowledge in the areas of training and learning, CTS may present a special case which warrants at least preliminary research of its own. The ideas which have been presented here represent only minimum considerations which need to be addressed in designing and evaluating CTS options.



## SOCIAL FACTORS

Matters of organizational constraints are wide-ranging. They have a very long-term time orientation when it comes to doctrinal changes, and can have quite a short-term orientation when it comes to in-combat decisions. For a host of other reasons as well, such constraints are complex and require a good deal of study. Yet, some predictive control can be realized, if all information resources are properly utilized. Training considerations are complex as well, but while there may be little research impinging directly upon CTS issues, there is a wealth of related knowledge to draw from.

The area of social factors, on the other hand, is at best a very complicated issue in the military environment. Relevant matters concerning CTS might include motivation, group cohesiveness, and morale of affected personnel.

**MOTIVATION.** For example, considering motivation only, what would be the likely effects of CTS on an individual's career progression? Will all forms of CTS provide the same promotion opportunities? Those which would most closely fulfill requirements of an individual's career path should be preferred to those approaches which require training time outside the career path. In one respect, such potentially detrimental effects could be avoided by not choosing CTS tasks outside an individual's career management field (CMF). An alternative for some tasks, naturally, is to make them part of common soldiering tasks; if not common to all soldiers, at least common to all personnel in the appropriate unit.

Another consideration is the question of who it is that gets assigned to CTS. For example, some individuals in support roles may have chosen these because such roles required only non-combat duty. The effect on these individuals of undergoing CTS would have to be considered. Also to be considered is the effect which the presence and actions of these individuals would have on more combat-prepared personnel undergoing the same training.

**COHESION.** A directly related topic concerns group cohesion. Using the COHORT (cohesiveness, operational readiness, training) model, the Army has been investigating cohort training and cohort transfers: the unit remains as an intact group in training and on duty tours (sometimes referred to as the New Manning Plan; AC 600-82-2). Such an approach can provide the group's members with shared experiences, and a common bond.

SUCH BONDS CAN BE BENEFICIAL IN TERMS OF PERFORMANCE AND A GENERAL TENDENCY TO RESIST THE ENEMY (Greenbaum, 1979). Social Psychology and Industrial-Organizational Psychology research has found that a commitment to super-ordinate goals (e.g., to a higher cause such as that of the Army or Society) is necessary for the formation and enhanced functioning of a primary group (e.g., a company or battery). The development and maintenance of these primary groups serves to reinforce an individual soldier's resolve and determination to perform under dangerous conditions (Shils, 1950). A strong correlate of such resolve is apparently the social support provided by other soldiers: Shiron (1976) found that peer ratings of a soldier's performance were tied to the social support he was perceived to provide to others. Those findings suggested that GROUP INFLUENCE HAS A GREATER EFFECT ON CARRYING OUT A MISSION THAN DID EVEN THE AUTHORITARIAN LEADERSHIP, the traditional way of life in the military.

The purpose of introducing the topic of cohesion is to point out its importance to overall group and individual performance, and the inherent personnel turbulence occurring during periods of surge. Severe turbulence can result in degradation of unit performance, a factor which must be taken into account in either evaluating or developing a CTS methodology.

A SOLUTION APPROPRIATE FOR SOME CASES WOULD BE TO BROADEN THE SIZE OF THE COHORT GROUP, thereby reducing the effects of "outside" substitutes on the group's performance--i.e., substitutes would come from within the cohort group itself. Another solution would involve rotation of personnel during training, so that key and support personnel could learn to perform effectively on the equipment, regardless of which particular individual is in which particular position. Such a tactic would at least moderate any negative effects on group cohesion which might result from required substitutions.

MORALE. A related and concluding note concerns morale. The reality of the surge situation would be that the unit or section was on the verge of being overtaken by the enemy threat or otherwise pushed beyond their capabilities. Those specifically trained with the critical activities as their primary tasks will have been neutralized. In one sense, the perception could be that even those best at their job had been overcome, and that individuals only secondarily trained were to be used in a stop-gap measure. In the worst case the alternative to having undergone CTS would result in a complete rout by a given enemy force.

EXACTLY WHAT LONG-TERM EFFECTS ON MORALE COULD RESULT FROM SUCH FACTORS NEEDS TO BE DETERMINED. Certainly any approach to CTS would have to include considerations of this nature if it is to have a realistic chance of being effective in the field. PROPER GUIDANCE WOULD BE TO DETERMINE PERCEPTIONS AND ATTITUDES OF AFFECTED PERSONNEL, ADJUST THE UNREALISTIC EXPECTATIONS THROUGH TRAINING OR COUNSELING, AND MODIFY THE TRAINING AS NEEDED TO TAKE INTO ACCOUNT SOME OF THE VERY REAL NEGATIVE EXPECTATIONS WHICH EXISTED. In one sense, the situation itself would have to be modified, e.g., either by providing more personnel support or more effective training, or by selecting personnel who were found to be unaffected by such concerns.

#### SUMMARY

The areas touched upon in the course of this paper have ranged across a variety of topics related to the development of a means to survive a concentrated enemy military threat. The direction chosen comprises a form of training termed "cross-training for surge."

As was previously conceded, the points discussed here represent only the minimum considerations to be addressed in such a training effort. However, taken together, these points do offer a framework of critical elements, and are intended to be used as a set of guidelines for the evaluation and/or planning of CTS options.

In order to facilitate the use of the framework as a set of guidelines, the main points will be presented below in a checklist format. Where possible, ideas have been presented in modular form, and this practice will be followed here as well. The modular approach is intended to make it less difficult to (a) deal with only those portions considered important to any particular training option under development, and also (b) to modify each section independently of the others.

#### CTS GUIDELINES: CHECKLIST OF MAIN POINTS

##### a. Organizational Constraints (p.7)

The CTS method under consideration should:

- (1) Identify a pool of mission critical tasks (the Target pool); (p.11).
- (2) Identify a pool of available, trainable personnel (the Source pool) (p.11).
- (3) Determine relative military utility of each Target-Source item pairing. SME's would determine if the costs, obvious and hidden, of preparing anticipated substitute personnel are offset by expected gain in combat capability (p. 12).

- (4) Reject infeasible Target-Source pairings (p. 12).

Potential constraining factors:

- (a) Role congruence (p. 13).
- (b) Aptitude prerequisites (p. 13).
- (c) Difficulties of accomplishing initial skills training (p. 14).
- (d) Difficulties of insuring skills maintenance (p. 11).

##### b. Training Considerations (p. 15).

Questions to be asked in evaluation of CTS:

- (1) Are critical tasks, as identified above, to be trained in isolation, or, a more preferred approach, trained as part of a logical sequence of tasks? (p. 15)

(2a) Are an individual's primary and secondary (CTS) tasks so closely related in procedural similarity, yet different in actual sequence of operation, that learning of one interferes with performance of the other? (p. 15).

(2b) Are primary and secondary tasks similar enough in significant ways to allow for rapid train-up?

(3) Alternative forms of CTS training to consider (p. 16):

(a) Amount of training required

(b) Method of training

(c) Job Aids

c. Social Factors Considerations (p. 17)

(1) Motivation: Affect on career progression? Provide opportunity to fully develop skills? Assignment to CTS made by individual or other? (p. 17)

(2) Cohesion: Effect on the "team" nature of the unit, in the face of substitutions? (p. 17)

(3) Morale: Is consideration in training given to prepare individuals for loss of leadership or sudden changes in roles? (p. 18)

To repeat, this brief list of features is meant to represent the minimum considerations to be addressed in designing or evaluating a CTS methodology. Situational concerns, such as type of unit, anticipated battle environment, and current budget considerations and doctrinal changes, might add to or otherwise require modification of such a checklist by various parties. These guidelines can be implemented in directing the design of CTS. The purpose here was also in part to provide a basic structure, a framework for use in examining questions and issues related to possible CTS approaches. As such, this may be considered as well a preliminary effort, intended as much to characterize the needs leading to CTS and potential related areas of investigation as to elicit responses from military planners.

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